

Utilization and Technology Validation Highlights



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End-Use Components



◆ **Reversible Fuel Cells - Renewable Energy Storage**

- ◇ Low Cost Reversible Fuel Cell - Technology Management Inc

◆ **Engines - End-Use**

- ◇ Natural Gas / Hydrogen blends - NRG Technologies
- ◇ Free piston - Sandia National Laboratory

◆ **Sensors - Safety**

- ◇ Gallium Nitride Integrated Gas/Temperature Sensors for FC System Monitoring H_2 and CO - Fluence
- ◇ Thick Film Hydrogen Sensor Detector - Oak Ridge National Laboratory
- ◇ Interfacial Stability of Thin Film H_2 Sensors - National Renewable Laboratory

◆ **Electrolyzers - Infrastructure**

- ◇ Home Refueling - Stuart Energy
- ◇ High Efficiency Steam Electrolyzer - Lawrence Livermore National Laboratory





Stuart Electrolyser



Hydrogen Infrastructure



◆ Las Vegas

- ◇ Co-production of hydrogen and electrical power
- ◇ Systems integration of hydrogen components
- ◇ Create and support local hydrogen fleet
 - Pure Hydrogen Hybrid Bus
 - Hydrogen/Natural Gas Blends



NRG's Crown Vic

◆ Sunline Transit Agency

- ◇ Support of the California Fuel Cell Partnership
 - H₂ Production
 - HBT Autothermal Reforming of Natural Gas

◆ H₂ source - the chicken and the egg

- ◇ Electrolyzers - Stuart Energy, Proton
 - Active discussion with major automobile manufacturers



Hydrogen Infrastructure



♦ Mining Vehicles

- ✧ Natural fit for PEMFC and Hydride technologies
- ✧ A market pull

♦ High Pressure Composite Tanks

- ✧ On board storage solution today - TBD

♦ Storage Safety Comparison

- ✧ Different technologies and fuels - SNL
 - Safety perception / certification

♦ Distributed Power

- ✧ Development of stationary fuel cells and hydrogen systems for stationary applications



Conformable Tanks



Northwest Power Systems Distributed Power Unit

